

It's Magically Simple - The 'Little Imp' Coil Winder

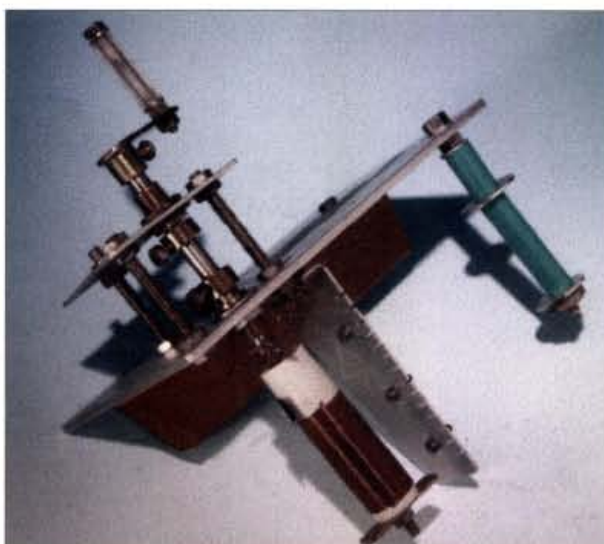
Winding home-made coils seems to most constructors to be a most difficult problem and is the most disheartening task of any project. Indeed, I often wonder how many projects fail to materialise as soon as coil winding appears on the agenda and the whole idea is dropped!

I was reminded of the problem when I read in **Rob Mannion G3XFD's** article 'Radio Basics' (PW September 1998 page 17) where he tells of "feedback from readers of the difficulties and confusion arising from coil winding".

The 'Little Imp' coil winder originally came about due to an article in PW April 1992 'Building A Dip Meter' by the **Rev. George Dobbs G3RJV**. In the article George says: "In the past, when I have written articles on projects using home-wound coils, more problems seem to come from these components than anything else but you aren't going to let me down are you"? I too have had coil winding difficulties in the past and the inspiration arose from wanting to build the 'dip meter' as a project.

The Coil Winder

The 'Little Imp' coil winder is not difficult to make and is constructed mainly from scrap metal with tools from



Barrie Rogers G0SQR describes how you can introduce a little 'miracle maker' into your shack ... and make the winding of those coils that much easier!

aluminium (this is important! as the rigidity in the finished winder really depends on this); any thinner it will be 'Waffy' in use*.

**Editorial note: We think that 'Waffy' is a Yorkshire term for 'Wobbly'. Southerners please note!*

The Main plate is cut with a hacksaw or preferably with a jigsaw with the plate clamped to the bench with a 'G' clamp with the cutting line clear of the bench edge. If you haven't got a 3mm piece in your scrap box, I suggest you visit the local scrap merchant and ask if you can look in the aluminium pile. (Mine was cut from a piece of old 19in rack panel front).

Note: It doesn't matter if the aluminium sheet you've chosen (or found) has any random holes in it from switch, meter or sockets. So long as you can drill new holes around any existing ones, there won't be any problems. Next cut out the **Front plate, Fig. 2**, from a piece of 'hard' aluminium 1.5mm thick.

The **Securing plate, Fig. 3**, can be 'soft' aluminium and is cut and bent before drilling out and filing the slot. The Front plate, Fig. 2, is now marked out for drilling and is given an extra heavy 'belt' (translated: 'blow' or 'thump!') from the 'centre-pop' (marking punch) so the drill doesn't wander off centre - a particular

problem in aluminium.

Left Or Right Handed

Now comes the versatility of the design - it is adaptable for right or left handed use according to your needs!

The Front plate is now placed on the Main plate

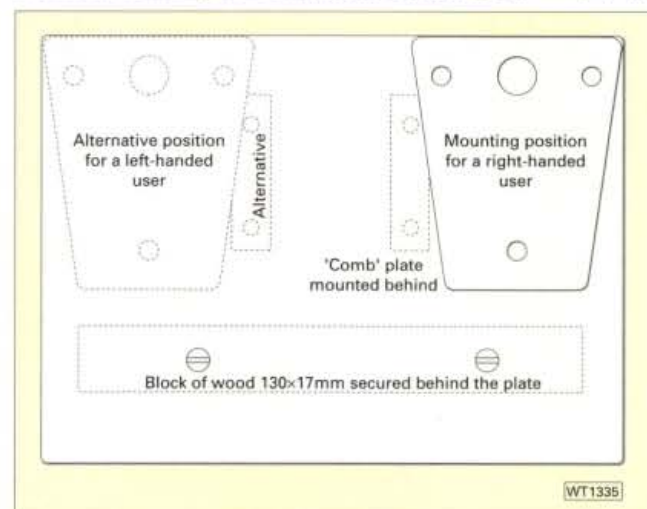


Fig. 1: The Main plate is cut from 3mm aluminium - this is important as the rigidity in the finished winder really depends on this (see text).

your normal workshop. However, construction should be approached with the right attitude!

Don't forget you're making a simple practical coil winder. **You're not making an entry for the Model Makers' Prize of the Year at the Model Engineers' Society Annual Exhibition!**

Start by cutting the **Main plate, Fig. 1** from 3mm Practical Wireless, April 2000

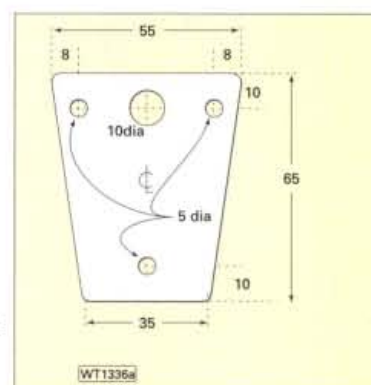


Fig. 2: The Front plate, is cut or fabricated from a piece of 'hard' aluminium 1.5mm thick (see text).

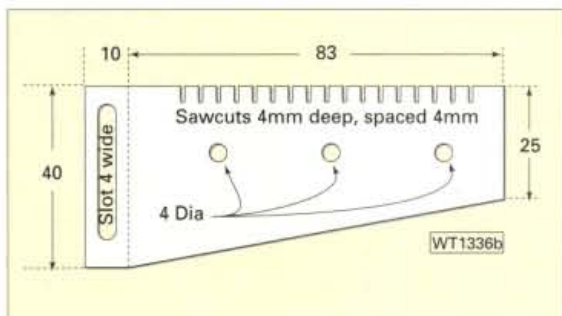


Fig. 3: The Securing plate, can be made from 'soft' aluminium and is cut and bent before drilling out and filing the slot (see text).

should be cleaned of all burrs and filed straight and square. Burrs on drilled holes can be removed by rotating a larger size drill in them by hand, allowing all nuts to sit square. Drilling of holes is best done with a cordless drill at a slower speed, rather than with a mains-powered drill screaming away at full bore and drifting off-centre!

Preparing The Brasswork

The two pairs of end cheeks should be cut from hard brass 1.6mm thick (0.064in). You may find it easier to lightly sand this before marking out, cutting to size, removing burrs and filing to shape. Holes are then drilled at centres in all four plates to clear a 4BA screw or a short piece (25mm) of studding.

A 4BA brass nut is then cleaned up with a fine file on all sides and the bottom face, to enable you to make a good soldered joint. However, you'll find it almost impossible to solder the nut to the cheek with a normal 25-40W iron.

Instead, you should clamp about 5mm of the end cheek in a vice with cleaned side upwards, poke a short 25mm screw or bit of 4BA studding from below and run the nut down the thread. Then, using a gas 'micro' torch (I used a full size blowtorch with the 'wick'

turned down a bit), the flame should be played on the brass cheek. At the same time solder is 'dabbed' onto the brass until it's seen to flow. Solder is then fed in until a fillet builds up on the cheek-piece.

The point of using a small bolt through the hole to steady the nut, is

that the 'pendulum effect' holds the nut flat on the brass. With this technique you don't end up trying to chase the nut across the piece of brass!

Extreme care must now be taken to allow the metal to cool fully before removing it from the vice. This is because, even with the heat sink effect of the bench vice jaws, brass still retains a lot of heat and it could cause some very nasty burns. Take care!

One of the small pair of cheeks is then clamped into the vice and filed down to the 'diamond' shape as shown in Fig. 4 (in the diagram, the dotted lines show the outline of the metal which has to be removed by filing, with the resultant 'diamond' shape shown coloured) at 5mm wide at the centre and pointed ends and the inside face is chamfered on all edges to allow easy passage of wire through without catching on 15mm formers.

The winding handle, Fig. 5, is now clamped in the vice and the piece of spindle coupler soldered as before, before filing to shape and fitting a short piece of 4BA studding for the handle which is a section of ball pen casing with lock nuts and washers to secure so it rotates freely.

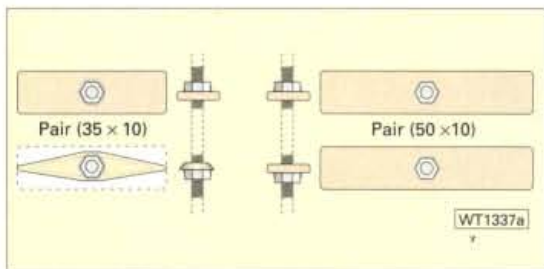


Fig. 4: One of the small pair of cheeks is then clamped into the vice and filed down to the 'diamond' shape (in the diagram, the dotted lines show the outline of the metal which has to be removed by filing, with the resultant 'diamond' shape shown coloured) at 5mm wide at the centre and pointed ends and the inside face is chamfered on all edges to allow easy passage of wire through without catching on 15mm formers (see text).

(See Fig. 1, left or right position) and clamped tight in your vice/jig so you can drill all holes at the same time without the drill chuck fouling the vice jaws. This ensures that all holes are perfectly in line in both plates to make assembly much easier.

All cut edges

Main Bearings

The two main bearings are made from the bearings of two old volume controls, broken out of the Bakelite cased types (Colvern) or sawn out of metal examples. Alternatively you can buy new ones from Maplins!

As I mentioned earlier, the 'Little Imp' is made mostly from scrap. The only new materials you are likely to have to buy are the 6.35mm rod with some 4BA and 2BA studding with nuts, washers, etc.

The two shaft spacers are made from a 6.35mm shaft couplers (brass) sawn in half. However, if you can drill and tap 4BA it should be cut into three equal pieces, with the centre section used on the winding handle. Alternatively ... buy two couplers and saw each in half (blow the expense!).

I remove the grub screws from shaft couplers and replace them with short 'cheese head' screws. This is because when I try to tighten them up, the grub screw heads shear off.

Cutting The Studding

The 2BA studding is now cut into three pieces about 45-50mm long for the Front plate to Main plate fixing and the bobbin support (at about 90mm long) with two spacers from a ball 'Pentel' case to fit over the studding with large washers. The 4BA studding is cut at about 85mm for the winding spindle, and a short piece about 40mm with a 25-30mm piece of 'biro' case for the rotating handle with required lock nuts and washers.

The most difficult part of the whole project is the winding shaft, Fig. 6. For this you have to cut a piece of 6.35mm steel axle rod 70mm long, drill a 3mm hole about 25mm deep, then tap it with a 4BA thread. This can only be done in a lathe and I was fortunate in having a pal who did mine.

But, do not despair! A visit to the local library will reveal the secretary of the local model engineers club who will be able to tell you of someone who will do this for you. He could be asked "How much?" or rewarded with a can of his favourite lager (this is a must) to show your appreciation!

Editor's note: I approached a small engineering company who operate from a nearby industrial estate to enquire how much such a job would cost. They told me that they would charge around £10 plus VAT - plus the cost of the material if this wasn't supplied. So, don't be put off this project if you can't manage a certain section ... there's always a way around the problem! **G3XFD.**

Assembly Stage

All being well, you should now be ready to start the assembly stages and to help, the fully assembled prototype 'Little Imp' is shown in Fig. 7. And to start the process, the two bushes are fixed to the **Front plate** and **Main plate** and tightened up.

Next, the three pieces of 2BA of 50mm long studding are put into holes 'A' 'B' and 'C' and the nuts tightened up and three 2BA nuts 'run on' to about 10mm. The main shaft (with handle mounted) is then inserted through the **Front plate** with the two spacers loose on shaft and then put through the **Main plate** with nuts run on to the ends of studding to hold everything in position.

Now comes the most important section of the assembly stages! Spacer 'A' should be tightened up: and by alternately tightening down the nuts on spacers 'B' and 'C', the **Front plate** is made to distort, so as to 'nip' the winding shaft in the bearings

and make rotation very stiff. (The point of this is so that when you do release the winding handle ... it doesn't spin back, and the winding stays tight against the pull from your wire holding thumb and forefinger).

The two spacers are then tightened up to stop end float in the winding shaft. **Again, I stress the importance of this adjustment as the whole success of your coil winder depends on this adjustment.**

The section of 2BA studding for the bobbin holder is put on the **Main plate** and tightened up. Suitably sized pieces of Pentel pen case are then cut and put on with large washers to hold the wire bobbin in position whilst rotating freely.

At this late stage in the article, I would suggest that if you're not contemplating winding coils as small as 4.7mm, you could ignore the **Securing plate** with its adjusting slot associated nuts and bolts.

Winding Coils

Let's now look at the actual process of winding coils on the 'Little Imp'. To this end, instructions or specification of coils in any article usually consist of the outside diameter (OD) of the former, wire diameter in s.w.g. or metric equivalent and number of turns, and whether close wound or spaced over a specific length on the former.

The 'Little Imp' will wind any coil from the smallest 4.7mm to 50mm with equal ease. (Depending on the size of end cheeks used).

With 4.7mm size no end cheeks are used and the former is slotted on the studding and secured with a 4BA nut. On my prototype most American old type plug-in coils were wound on 1in (32mm) Bakelite formers.

Newer type circuits use 15mm formers, the G3RJV dip meter is one example and suggest plumber's 15mm plastic pipe. Despite this, I prefer 15mm till roll centres.

Most of today's till roll tubes and office equipment use the same size but of various lengths, and are 'binned' when empty. I asked the supervisor at my local Safeway's customer service counter if she would save some for me and on the next weekly visit received a large number in a carrier bag free of charge!

Most copper wire for coil winding comes on 50g or 2oz reels. Mostly these are of 41mm diameter, 31mm long and 11.5mm bore.

A point to mention at this time is that the UK s.w.g. and American Wire Gauges (AWG) are **NOT** the same and should be checked against a set of copper wire tables (as in *The ARRL Handbook*). If s.w.g. is quoted, this is the 'normal' gauge and can be used without reference to tables.

If you have some copper wire to hand (i.e. wire from the scanning coils from a scrap TV set) it should be measured with a micrometer and checked against a set of copper wire tables. But if bought on 50g reels you'll find that the metric equivalent or the s.w.g. is printed on the label ... so no bother!

To start winding coils you'll need a reel of wire, a former and a 1.5mm drill in a pin vice to drill holes at required positions (this should be kept close to hand when winding). The former is placed on the winding spindle with 'diamond' cheek inside and the outer cheek is tightened up.

Please note: It is important to carefully centralise the former on the spindle so it rotates without any wobble, and it also makes it so much easier for the wire to be fed on neatly. A 1.5mm hole is drilled about 5mm from the outer edge and when cleared, the pin vice is kept turning.

The angle of the drill should be slowly tilted over to put a 'chamfer' towards the 'diamond' cheek at the bottom of the former. About 80mm of wire is then pushed through this hole and a couple of turns wound round the pointed end to secure it firmly.

Wire from the bobbin is then fed on through thumb and forefinger to the former and if it goes out of line ... just reverse the handle and carefully rewind. Set up the winding handle at the bottom point for reference and start counting, **every time the handle reaches the bottom you'll have completed one turn.**

When the instructions tell you to wind on 60 turns - and make a tapping - then wind on 12 more turns. In this case I think it's best to stop one turn short (this is where you can let go of the winding handle as due to its stiffness it won't unwind) and holding the wound turns tight to the former with the thumb and forefinger a 1.5mm hole is drilled, also another alongside it. (Again, tilting the drill sideways).

The end is then cut at about 80mm long, fed through the hole, pulled tight and two turns wound round the 'diamond' cheek end point. An 80mm end of wire is now put through the adjacent hole, secured on the 'diamond' plate, the final 12 turns wound on and drilled and secured as before.

A dab of 'Superglue' is then placed on each wire hole and left to set and harden. The former is then removed from the spindle end cheeks and unwound from the 'diamond' end and wires are straightened out for 'tinning'.

The start and finish of each winding can be checked by looking down the centre of the former. Next, the end of 60 turns and start of the 12 turns are cleaned

Material Sources

Metals	Catalogue from Hobby's model shops W Hobby Ltd. Knights Hill Square London SE27 0HH Tel. (0181) 761 4244	
Studding	2 BA - 305mm long 4 BA - 305 mm long	Part No. 12036 Part No. 12037
Nuts & Washers	2 BA hex nuts (Pkts 10) 4 BA hex nuts (Pkts 10)	Part No. 12039 Part No. 12040
Brass Strip	0.064in (1.62 mm)	Part No. MS/246
Steel Rod (Axles)	6.35mm long	Part No. TA4
Copper Wire	All 50gm reels 16s.w.g. to 40s.w.g.	

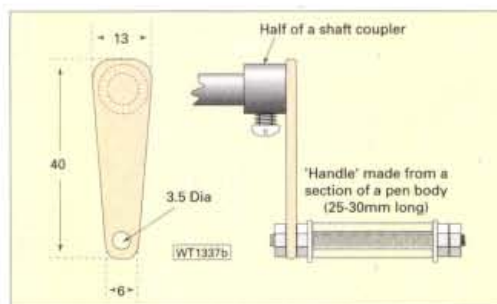


Fig. 5: The winding handle is now clamped in the vice and the piece of spindle coupler soldered as before, before filing to shape and fitting a short piece of 4BA studding for the handle which is a section of ball pen casing with lock nuts and washers to secure so it rotates freely (see text).

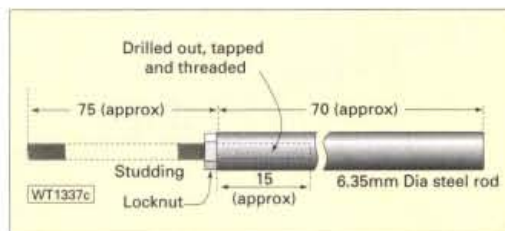


Fig. 6: The most difficult part of the whole project is the winding shaft. For this a piece of 6.35mm steel axle rod 70mm long, drill a 3mm hole about 25mm deep has to be cut and tapped with a 4BA thread. This can only be done in a lathe (see text for advice on this matter).

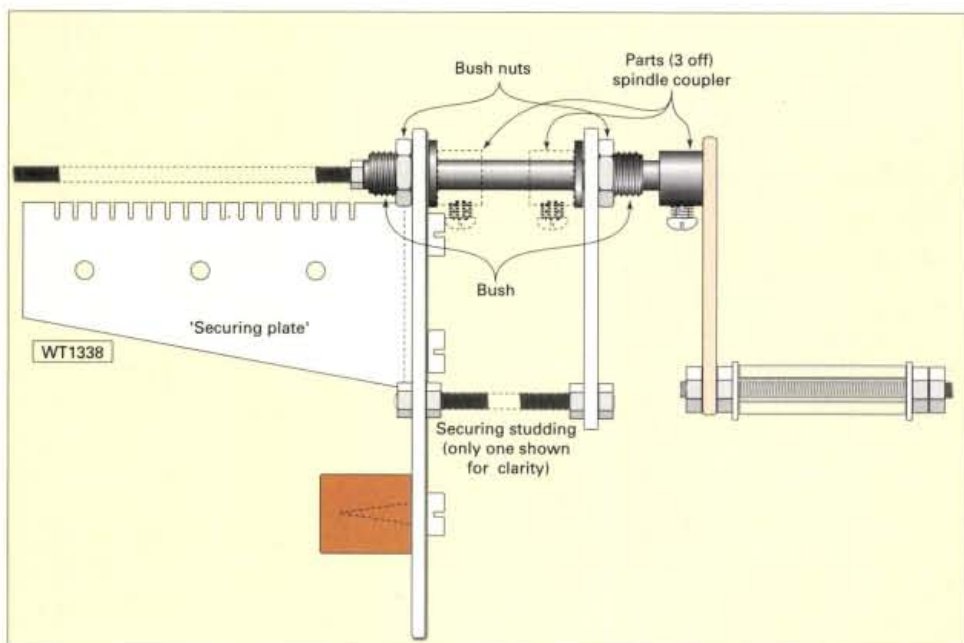


Fig. 7: The fully assembled prototype 'Little Imp' - shown for guidance to help with assembly (please also see heading photograph).

and soldered together for the tapping point. For ease of cleaning and tinning, I use a piece of wood 30mm wide, 150mm long by about 10mm thick clamped on to my bench with a 'G' clamp sticking outwards at right angles.

Using my method, the wire end to be cleaned is then laid on the wood and the wire is slowly turned and scraped with a sharp knife. The coil is then ready for soldering to the DIN plug (if you're making coils for the G3RJV dip meter) and gluing to the former with Araldite.

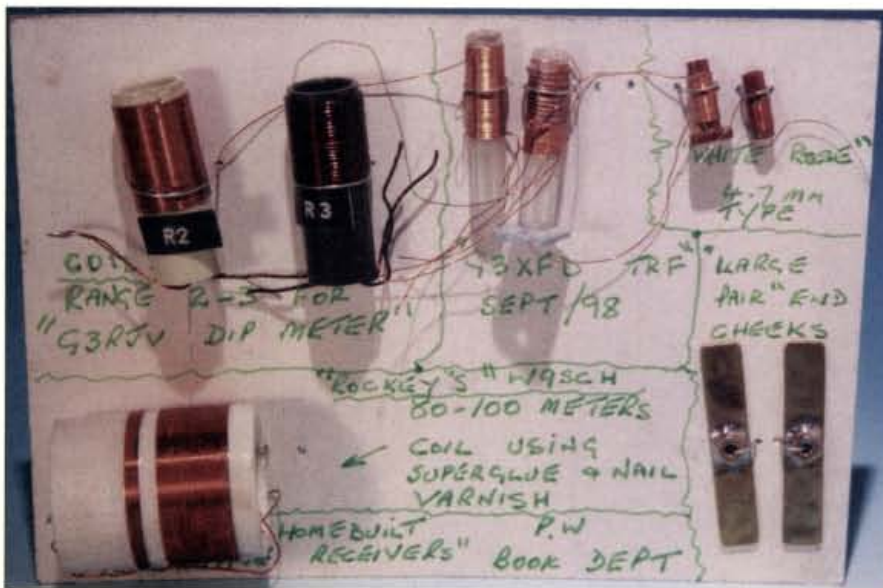
Some coils are suggested to be wound on 35mm plastic film canisters. If you're using these, they should be drilled out at the closed end for mounting on the 4BA spindle with suitable end cheeks.

Winding Small Coils

Fig. 8: Author's photograph and annotations showing various coils wound on the 'Little Imp' coil winding machine (see text).

Using the 'Little Imp', small coils can be wound as easily as large ones. But they do require a little more patience in setting up, plus the waiting time for the adhesive to set and harden. Additionally, to wind coils on 4.7mm formers you'll need to have the **Securing plate** (Fig. 3) in position.

A long 4BA solder tag is put on the winding shaft



next to the lock nut followed by the former and held tight by one of the small cheeks. (I use a large nut from an old 4.5V 'Bell' battery).

The end of wire, about 60mm is passed through the solder tag hole with a couple of turns wound in and around the hole (so it doesn't slip) with the solder tag bent to the point you want the winding to start.

Next, you should wind on the required number of turns. Where the wire finishes on the former it should be laid at right angles in the nearest slot on the 'securing' plate and is then cut (leaving about 60mm 'tail' to wind round the nearest 6BA screw).

Adhesives On Start & Finish

So, the winding is now on the former ... but it needs some adhesive on the start

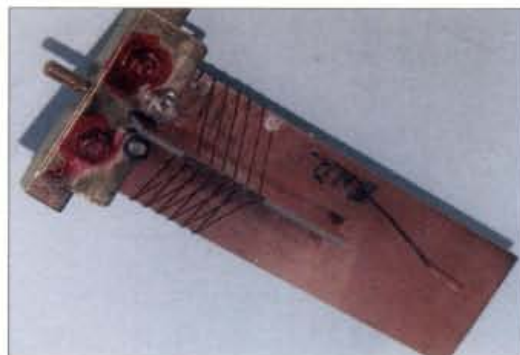


Fig. 9: Adapter made by the author to enable winding 'Cruciform' type coil formers as used in the 'Radio Basics' 'Tinny Dipper' project.

and finish point where the wire leaves the former before you even think about attempting to remove it! I have used various adhesives to secure windings, and help you ... here they are:

- 1: Nail varnish
- 2: Balsa cement
- 3: Evostick

Whatever you use, a blob must be applied to start and finish and left in position until set and hardened. A second blob must be applied over the ends and also left to set and harden.

All of the adhesives I've mentioned shrink to a very thin film on drying, hence the need to apply two coats or, in my case, I use at least three thus making sure the turns stay firm at the anchor point when removing from the spindle.

Evostick is very good and sets a bit more quickly. However, you have to apply the blob with a small screwdriver and you can also get long 'strings' of the solution from the can to screwdriver ... but it doesn't shrink so much on drying.

The choice of adhesive is up to you. I suggest you wind a couple of coils to become familiar with the 'Little Imp' before using and trying the properties of different adhesives.

So, that's how I built my coil winder. I hope you enjoyed the article and I hope it makes it quite clear how you can wind any coil, large or small on your own 'Little Imp'. Happy winding! **PW**